

23. The apparatus of claim 22, wherein the capacitor is a cylinder stack (OCS) - type capacitor.

24. The apparatus of claim 23, wherein a numerical target of the growth degree of grains includes sidewalls of the OCS-type capacitor.

25. An apparatus for numerically analyzing a growth degree of grains on a surface of a semiconductor wafer, comprising:

a scanning electron microscopy (SEM) for scanning a specific portion of the surface of the semiconductor wafer to generate an image signal;

an analog-to-digital converter for converting the image signal generated by the scanning electron microscopy (SEM) into digital data;

a display device for receiving the image signal and displaying an image of the specific portion of the surface of the semiconductor wafer on a screen; and

a computer device capable of (i) storing the digital data as an image file, (ii) forming mesh lines for dividing the screen into a plurality of sub areas over the displayed image of the specific portion of the surface of the semiconductor wafer, (iii) opening the stored image file to perform a standardization with respect to image data of respective pixels disposed within a numerical target zone that is manually selected by an operator by designating a predetermined sub area on the screen, (iv) comparing standardized image data values of the respective pixels with a predetermined threshold value, (v) counting the number of pixels whose standardized image data value is greater than the threshold value, (vi) numerating the growth degree of grains on the surface of the numerical target zone by calculating a ratio of the number of the counted pixels with respect to a number of total pixels disposed

within the numerical target zone, and (vii) providing the calculated ratio to the display device to thereby display the calculated ratio on the screen.

26. The apparatus of claim 25, wherein the computing device further comprises a capability for performing a smoothing process for smoothing the image data of respective pixels disposed within the numerical target zone using an average value of image data of adjacent pixels.

27. The apparatus of claim 25, wherein the standardization is performed using a following equation:

$$NC_{ij} = \left(\frac{C_{ij} - C_{\min}}{C_{\max} - C_{\min}} \right) \times K$$

wherein, NC_{ij} is a standardized image data value of a pixel disposed at a point (i,j),

C_{ij} a non-standardized image data value of the pixel disposed at the point (i,j),

C_{\min} is a minimum value of image data within the numerical target zone,

C_{\max} is a maximum value of image data within the numerical target zone, and

K is a constant.

28. The apparatus of claim 27, wherein the constant K is the number of total gradation of the monitor.

29. The apparatus of claim 25, wherein the image file comprises image data obtained by scanning a growth state of hemispherical grains (HSGs) grown on a surface of a capacitor.

30. The apparatus of claim 29, wherein the capacitor is a cylinder stack (OCS) - type capacitor.

31. The apparatus of claim 30, wherein a numerical target of the growth degree of grains includes sidewalls of the OCS-type capacitor.